

# PATENT SPECIFICATION

(11) 1 206 576

## DRAWINGS ATTACHED

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- (21) Application No. 4617/69 (22) Filed 28 Jan. 1969  
 (31) Convention Application No. 705 350 (32) Filed 14 Feb. 1968 in  
 (33) United States of America (US)  
 (45) Complete Specification published 23 Sept. 1970  
 (51) International Classification F 27 d 5/00  
 (52) Index at acceptance F4B 32



## (54) A METHOD OF FIRING ELONGATED ARTICLES IN A KILN

(71) We, CHAMPION SPARK PLUG COMPANY, a corporation organized and existing under the laws of the state of Delaware, United States of America having our principal offices at 900 Upton Avenue, Toledo, Ohio, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates generally to a method of firing a plurality of elongated articles in a kiln.

At the present time it is difficult to load small elongated articles such as green spark plug insulators into saggers for firing in a kiln such that the articles remain spaced and upright during firing. If the articles are not upright during firing, a high percentage may be defective due to warpage. The problem is particularly difficult because of variations in sagger ware size. It is seldom possible to pack the articles tightly enough so that during subsequent moving of the saggers they will not tilt or fall over. Even if possible, it may be undesirable to pack the articles tightly because of ware damage.

Accordingly, it is an object of the present invention to provide a method of firing a plurality of small elongated articles in a kiln such that the number of defects caused in articles during firing in a kiln is reduced.

The present invention consists in a method of firing a plurality of elongated articles in a kiln comprising the steps of, placing in a sagger having a generally horizontal bottom, a generally planar combustible spacer having a plurality of apertures adapted to receive and to hold the articles upright, said apertures having a centre-to-centre spacing greater than the maximum lateral dimension of the upright articles, supporting said spacer in a generally horizontal position at a level spaced a selected

distance above the bottom of the sagger, and placing the articles in an upright position in said apertures.

In the accompanying drawings:

Figure 1 is a top plan view showing a combustible support according to the present invention:

Figure 2 is an enlarged cross-sectional view taken along line 2—2 of Figure 1 showing formed cups of the invention in detail;

Figure 3 is a side elevation of a portion of the support showing elongated articles positioned in the cups; and

Figure 4 is a cross-sectional side view of two stacked saggers, each holding a support and articles.

Referring to Figure 1, the tray or support 10 comprises a single flat sheet 12 of combustible material having a plurality of spaced cups 14 formed therein.

The sheet 12 is made from a material which will burn easily and leave at most a trace of ash. Preferably, the material is a synthetic resin, e.g., a low ash, non-filled unoriented butyrate, polystyrene or polyethylene, however, other combustible materials such as cellulosic sheets are satisfactory. To reduce the cost and the amount of ash formed during combustion, the material should be just thick enough to have the necessary strength to support the articles.

Construction of the cups 14 is shown in detail in Figure 2 and 3. When the support 10 is manufactured from a flat sheet of material 12, cups 14 can be vacuum formed or pressed into the sheet; where the support 10 is manufactured from raw material, it can be injection molded. The vacuum forming process will normally cause the sides 16 to be tapered toward the bottom 18 of the cups 14 and will cause the bottom 18 of the cups to be very thin. However, the use of a mould as the cups are vacuum formed will produce a more uniform thickness in the walls and the bottoms

[Price 5s. 0d. (25p)]

of the cups 14. This may be necessary to give the support adequate strength. The sides 16 of the cups 14 serve primarily to support the sheet 12 above the horizontal sagger bottom 20 and secondarily to hold the articles 22 straight in the cups 14. The bottoms 18 of the cups 14 serve no useful purpose and may therefore be very thin. As shown in Figure 3, the weight of the articles 22 will flatten or collapse the thin bottoms 18 of the cups 14. If the sheet 12 and the cup sides 16 burn away before the cup bottoms 18 burn away the thin, collapsed bottoms 18 are not thick enough to cause the articles 22 to tilt or fall.

The combustible support 10 can be designed to hold any small elongated articles 22 which are to be fired in a kiln, such as spark plug insulators as shown in Figure 3. The cups 14 are shaped to receive the upright articles 22. The centre-to-centre spacing of the cups 14 is slightly greater than the maximum diameter A of the articles 22 (see Figure 3). Consequently, the articles 22 are separated and held upright by the support 10.

Referring to Figure 4, which is a cut away view of two stacked saggars 24 and 26 and a sagger cover 28, the sheets 12 of the combustible supports 10 have overall dimensions slightly smaller than the interior dimensions of the saggars. This facilitates insertion into the sagger, but movement of the supports 10 within the saggars is minimized. Since the supports 10 are preferably of thin synthetic resinous material, they will not support the full weight of the articles and are, therefore, inserted into the saggars prior to loading of the articles 22 thereto. However, the support can be constructed thick enough to act as a tray and, in that instance, can be filled before it is placed in the sagger.

In one example of the support, a sheet of synthetic resinous material about 0.01 inch thick and about 13 2/5 inches square is vacuum formed with an 18 by 18 grid of spaced holes 9/16 inch in diameter to receive green spark plug insulators. The material selected should produce less than 0.02% ash when burned to prevent discoloration of the insulators. The support is then placed in a sagger

having interior dimensions of about 13 1/2 inches square and 4 inches high and a wall thickness of 5/8 inch. Six to nine saggars are filled with green spark plug insulators and stacked. The stack is then covered and conveyed through a kiln for firing.

In another embodiment of the invention, the support comprises a single flat sheet of combustible material having holes cut into it adapted to receive the upright articles. The sides of cooperating saggars are notched or grooved to hold the support at a predetermined height above the bottom of the sagger.

It will be appreciated that although the cups are shown as formed with rounded bottoms, any other convenient shape may also be formed. In many instances a generally flat bottom for the cups will be required.

#### WHAT WE CLAIM IS:—

1. A method of firing a plurality of elongated articles in a kiln comprising the steps of, placing in a sagger having a generally horizontal bottom, a generally planar combustible spacer having a plurality of apertures adapted to receive and to hold the articles upright, said apertures having a centre-to-centre spacing greater than the maximum lateral dimension of the upright articles, supporting said spacer in a generally horizontal position at a level spaced a selected distance above the bottom of the sagger, and placing the articles in an upright position in said apertures.

2. A method as claimed in claim 1, wherein the apertures in the spacer form open tops of cups which provide the support for said spacer.

3. A method as claimed in claim 2 wherein each cup has a thin collapsible bottom which does not prevent the article from standing upright in the sagger if the rest of said spacer burns away.

4. A method as claimed in claim 1 or 2 wherein the spacer is fabricated from a thin sheet of a combustible synthetic resinous material.

5. A method of firing a plurality of elongated articles in a kiln substantially as described.

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